Proceedings of the 6th Annual British Columbia Mine Reclamation Symposium in Vernon, BC, 1982.
The Technical and Research Committee on Reclamation

RECLAMATION RESEARCH AT B.C. COAL

Paper Presented
by

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INTRODUCTION

B.C. Coal's Balmer Operation is located near Sparwood in southeastern British Columbia. The area is one of rugged relief ranging from 1125 m to 2100 m above sea level. The mine is a truck and shovel operation using wrap-around dump construction, and rock types encountered include a mixture of sandstones, siltstones and carbonaceous shales. These materials are slightly to moderately alkaline with pH's ranging from 7.5 to 9.5, and all materials present erode fairly quickly producing fines which greatly aid reclamation efforts. The standard reclamation practice for these large areas is to recontour the dumps to less than 26°, then apply seed by helicopter in the autumn. Following application the seed is harrowed in, using a large bulldozer-pulled pipe harrow to break surface crusts and create favourable microsites for germination. The areas are given annual fertilizer applications of 13/16/10 at *a* rate of 200 kg/ha in the early spring before growth commences.

By the year 2023 the mine operation will have approximately 16.5 square miles of land disturbed by mine activity, and to date the company has about one-sixth of that area dormant and reclaimed. Research activities have started on these sites in order to make reclamation activities more efficient.

The purpose of this paper is to outline some of the reclamation research activities that are currently underway at B.C. Coal.

In general, research activities fall into one of four overlapping classes:

1. Baseline research and inventory on lands prior to mine activity.

2. Nursery and greenhouse research.

3. Monitoring of: reclaimed lands.

4. Ecosystem development and characterization studies.

BASELINE RESEARCH AND INVENTORY

A number of research projects currently underway at B.C. Coal fit into the category of baseline research and inventory. One study examines in detail the effects of slope, aspect and rock type in governing the patterns of vegetation on local slopes prior to mine activity. This will aid in the planning of island plantings; the next stage in the reclamation procedure. Deciduous and coniferous stock will be used, in order to provide both heterogeneity of vegetation and wildlife cover.

Two wildlife research projects also fall into the category of baseline research. The first is designed to give some idea of elk population dynamics and is trying to establish patterns of elk: use on the property. Identification of habitat use by these and other ungulate species will enable us to better predict the impact of expansion of mine activity.

It is generally believed that winter range is the limiting factor for ungulate populations in the Rockies. Therefore a second wildlife study was initiated to provide an estimate of browse productivity and utilization on those areas that have been identified as useful winter range. This information will be used to estimate the carrying capacity of ungulates in the area.

GREENHOUSE AND NURSERY RESEARCH

B.C. Coal has two 15 m x 9 m greenhouses and 6.8 ha of nursery in production at Sparwood, B.C. These facilities are used to produce native trees and shrubs for outplanting on lands disturbed by mine activity. Research activities in these facilities are aimed at establishing techniques for large scale production of species that will be potentially useful in reclamation efforts. In 1981 research was aimed at testing common herbicides as suitable weed control agents in a nursery devoted to native tree and shrub production. In addition, long term studies investigating pretreatments of a number of native shrubs are underway.

RECLAMATION MONITORING

Reclamation monitoring involves annual sampling to give estimates of species composition, detritus cycling and total productivity on each of

the major reclaimed sites. Particular attention is given to those sites that have been removed from the annual fertilizer program.

ECOSYSTEM DEVELOPMENT AND CHARACTERIZATION STUDIES

A number of the research projects undertaken at B.C. Coal are designed to increase our knowledge of ecosystem development on revegetated spoil materials. Since organic matter turnover and nitrogen budgets are two of the more important cycles in the development of terrestrial ecosystems it is in these two areas that research efforts have been directed.

NITROGEN

Microorganisms that are capable of fixing atmospheric nitrogen are easily divided into two groups: those that are free-living organisms and those that are associated with higher plants. A number of studies involving nitrogen fixation have been undertaken at B.C. Coal; one on the role that free-living N-fixers (blue green algae and bacteria) play in reclaimed sites, and others looking at nitrogen fixation by legume-associated microorganisms. This year tentative identification of those organisms that were actually fixing nitrogen were made. Quantification of amounts fixed will be studied in future research projects.

Research involving the role of fertilizer inputs into the reclaimed ecosystem is also underway. During 1982 one study will utilize N15 a heavy isotope of nitrogen to label fertilizer. This will allow us to trace the flow of nitrogen through the system; how much goes into the plants and how much is lost from the cycle. This will also hopefully allow us to determine which organisms are responsible for the majority of the cycling of nitrogen in these systems.

DETRITUS TURNOVER

Organisms that are responsible for decomposition are mainly bacterial and fungal. However work done by Fyles (1980) indicated that these microorganisms alone could not explain the amount of decomposition that was observed on the reclaimed sites. Further study indicated that soil fauna may be responsible for turning over much of the above ground detritus present.

Preliminary results correlate high detrital loss with high collembola (springtail) populations. A research project is being organized to identify other organisms important in organic matter incorporation into the spoil on these sites.

CONCLUSION

Much of the work that has been described in this paper is work done by graduate students at the University of Victoria, the University of British Columbia and the University of Alberta. Cooperative research programs such as this help industry to make contacts with a wide range of expertise in the form of graduate students, their supervisors, and committee members, while at the same time answering questions related directly to their operating procedures. At B.C. Coal an effort is made in gaining a better biological understanding of the ecosystems that are being created, in order to aid in the delineation of suitable land-use planning and to avoid potential problems before large areas of land have been affected.

LITERATURE CITED

Fyles, J.W., 1980. Vegetation and soil development on reclaimed mine lands at high elevation in southeastern British Columbia. M.Sc. Thesis. University of Victoria.

DISCUSSION RELATING TO DAVE FRASER'S PAPER

Harry Quesnel, Ministry of Environment: I'd just like to make a comment. People often talk about the economics of native species versus agronomics. I suppose just for the straight cost of the seeds, native species are most expensive, but I wonder if people consider the value and cost of fertilizer and its application with agronomics - especially considering that the money could be in the bank collecting 15% to 20% interest over the length of the project. The reason I mention this is that you were saying that you use a large number of agronomics which represents a large capital cost.

Answer: Well all our returns are not in. We're looking in the near future at how much fertilizer is actually required by the agronomics. The standard information you get when you come to symposia like these is that agronomics die out, require more fertilizer, and at high elevations don't produce viable seed. I'm not seeing hard-core scientific data coming out of our sites that would support all of that. We certainly have viable seed production of agronomic species and these seeds are actually germinating, but we are going to have some fairly strong selection pressures acting on the seeds. We may well be producing ecotypes of agronomic seeds, providing that we have a large enough genetic base to begin with, that will survive some of the conditions we're asking for. I think that in the next little while we will have to reduce fertilizer application on the sites and give them the acid test and see whether or not they actually survive on their own. Certainly we're going to have organic matter cycling and nitrogen cycling. Preliminary work seems to indicate that a lot of agronomics are going to go. The other information I've got from my own work with native grasslands is only partially complete, but suggests that some of these agronomics we're putting in are very aggressive. They are moving across native grasslands at those elevations quite readily without any application of fertilizers. That, to me, suggests that they have a much wider tolerance than we give them credit for.

Harry Quesnel, Ministry of Environment: Just another comment., Many agronomics are used with the philosophy of putting lots of nitrogen and phosphorous and other nutrients into the crop, then harvesting

the crop along with the nitrogen and phosphorous. Maybe one thing to consider is that here you're not harvesting the crop except for feeding by the elk, and maybe the nutrient cycle is not being completed as fast. For that reason the nitrogen fertilizer might have a greater longevity than you expect.

Answer: Yes, that is very true. Our approach is to seed with agronomics and fertilize them to produce high amounts of organic matter. This organic matter will eventually be turned into soil material. It is a way of topsoiling without actually going out with a truck and doing it, and is a lot cheaper.